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Study on turbulent characteristics of flow boiling in a micro gap under the influence of surface roughness and micro fins (Article)

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Abstract

Micro gap heat sinks with internal micro fins are potential candidates for evaporative cooling of miniature electronic devices. Generation of turbulence during flow boiling in a micro gap is an important issue in two-phase heat transfer analysis. Surface roughness and fins play important role in turbulence generation. In this paper, effects of micro gap height, surface roughness and fin spacing on turbulence generation during flow boiling of pure water in this particular heat sink have been investigated by numerical simulation. Commercial software FLUENT 14.5 release has been used for simulation purpose. Volume of Fluid (VOF) model along with Renormalization Group Theory (RNG) based k - ε turbulence model has been used for fluid flow and heat transfer modeling. Simulation results demonstrate that turbulent kinetic energy increases in the flow direction due to large pressure drop inside micro gap. As pressure drop decreases with the increment of gap height, turbulent kinetic energy also declines. For the same reason, it has been found that generation of turbulent kinetic energy is lower for larger fin spacing. On the other hand, effect of surface roughness on turbulent kinetic energy is dominated by flow scale. For same Reynolds number, turbulence in larger fluid domains is more sensitive to surface roughness than smaller flow fields. © 2006-2016 Asian Research Publishing Network (ARPN).

Author keywords

Flow boiling; Micro fin; Micro gap; Pressure drop and turbulent kinetic energy; Surface roughness

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